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THE FACE OF THE EARTH.

Das Antlitz der Erde. Von Eduard Suess. Mit 23 Textabbildungen, 6 Tafeln und einer Karte der Scheitel Eurasien's. Dritter Band. Erste Hälfte. Pp. iv + 508. (Wien: Tempsky, 1901.) Price 25*s.* net.

La Face de la Terre. Par Eduard Suess. Traduit avec autorisation de l'Auteur et Annoté sous la Direction de Emmanuel de Margérie. Tome II. Pp. 878. (Paris: Colin, 1900.)

SINCE the publication of Lyell's "Principles" no general treatise on geology has aroused more interest or exercised a more important influence on the evolution of geological ideas than "Das Antlitz der Erde," the first two volumes of which were reviewed in NATURE of April 25, 1889. Thirteen years have elapsed since the second volume appeared. It left the plot—if we may be allowed to use that expression—in a somewhat complicated condition, but the interest was maintained and not a little curiosity was aroused as to how the distinguished author would weave the various threads together. The first part of the last volume is now before us, but the mystery is not solved. We must wait with such patience as we can command until the conclusion appears.

As the leading ideas which run through the entire work may not be familiar to all readers of NATURE, a brief account of them will be given before proceeding to the review of the new volume. It must, however, be remembered that the work contains a careful and elaborate statement of facts relating to the structure of almost every part of the world, and is, therefore, of great value as a work of reference, quite apart from the truth or error of the theoretical views of the author.

A study of the structure of the earth's crust proves that it has been affected by two types of movement—the one characterised by a compression of the stratified rocks along certain zones, the other by a separation of the crust into blocks, some of which have sunk down relatively to others. The first type is best illustrated in modern mountain ranges, such as the Alps and Himalayas, the second in districts which have not recently been affected by folding movements.

One and the same area cannot be simultaneously affected by these two types of movement, but a folded zone may, after the folding stresses have ceased to act, be broken up by more or less vertical faults and by the sinking down of certain portions. It is probable that no part of the earth's surface has escaped the action of lateral pressure, but large tracts—as, for example, the north of Russia—have not been affected by it since pre-Cambrian times.

By the sinking of certain areas ocean basins are formed, enlarged or deepened, and terrestrial features like the Great Rift Valley of Central Africa are produced. When the sinking process takes place those parts of the crust which remain stationary, or which do not sink so much as the others, are termed "horsts." According to the author, the continents are of the nature of "horsts"; they have not been formed by elevation, but by the sinking of the intervening tracts.

In support of such a view he refers especially to the fact that no proofs of the presence of a Mesozoic sea are to be found over southern India or the corresponding portion of Africa. On the contrary, the continental deposits of the Gondwana and Karoo series end off abruptly against the ocean. Such facts as these are, he considers, incompatible with the view that continents have been formed by elevation.

But although the existing oceans have been formed by depressions, it must not be supposed that all parts of any one ocean are of the same age, any more than that the continents have been formed by one simple or continuous process. The modern Atlantic, for example, has probably been produced by an enlargement in a northern and southern direction of Neumayr's Centrale Mittelmeer.

The geologist, however, has not only to deal with movements of the earth's crust, but also with changes in the relative level of land and sea. In speaking of such movements Prof. Suess considers that we should adopt a phraseology independent of theory. A rise of sea-level he terms a positive movement and a sinking of the sea-level a negative movement. The Black Sea and the Ægean Sea are both of quite recent date. If no water occupied these areas before the sinking took place, a lowering of the sea-level all the world over to the extent of about four metres must have been produced when they were formed. The crust of the earth breaks in and the sea follows; but whilst the depressions of the lithosphere are limited in extent the lowering of the sea-level is universal.

If we study the succession and distribution of sedimentary deposits we find, over large areas, clear evidence of transgressions or, in other words, of positive movements; these must have been of great extent and duration. Comparative stratigraphy shows that the positive and negative movements are too widely extended to be due to local movements of elevation and depression affecting the solid crust. Thus the Upper Cretaceous transgression, which forms such a striking feature in the geology of southern England, makes itself felt on the Amazon, on the Athabaska and on the Elbe, on the banks of the Nile and in the Tarim Basin, in the valley of the Narbudda and in Borneo, in the island of Sachalin and on the banks of the Sacramento.

The very fact that we are able to employ the same terminology to distinguish the broader sedimentary groups in all parts of the world is a proof that the limits of these groups have been determined by general and not by local causes. England is peculiarly well adapted to furnish the basis for a general classification, because the more important negative movements are here clearly marked out by the intercalation, in the marine series, of continental or fresh-water formations; and the limits established by William Smith and his successors correspond, for the most part, to these movements. At the commencement of a negative phase portions of the oceanic areas become isolated, saline and gypsiferous deposits are formed and the marine fauna becomes impoverished, but its final disappearance only takes place after the negative phase has reached its maximum.

It must not be supposed that the movements are continuous. Just as the actual limit of the water is continually oscillating backwards and forwards during the rise and fall of the tide, so it is with the positive and negative movements which are recorded in the rocks; the positive movements appear to last much longer than the negative movements which follow them. From the Rhætic to the Callovian in Europe there was an encroachment of the sea upon the land subject only to minor regressions, but the succeeding negative phase which is marked by the Portlandian and Purbeckian was of comparatively short duration.

How are these slow positive movements to be accounted for? The deposition of sediment necessarily tends to produce a continual rise of the sea-level. The formation of the Black Sea and the Ægean Sea, as we have pointed out, would account for a general lowering of the sea-level to the extent of 4 metres; but to produce a corresponding movement in the opposite direction by denudation and deposition would require the transference of an amount of solid rock equivalent to the lowering of the general surface of the land by as much as 10 metres.

The author, however, hesitates to draw the conclusion that the principal positive movements are the result of this cause, and favours the idea that, in some unknown manner, the waters of the ocean have been alternately heaped up at the equator and the poles.

We turn now to the volume which forms the more immediate subject of this review. It deals mainly with those portions of Asia on which so much light has been thrown during the last decade by the indefatigable researches of Russian geologists; the method of treatment is that with which all readers of the first two volumes are familiar. Broad generalisations are suggested in a few words, and then follows a mass of local detail which it is impossible to understand fully without better maps than those which illustrate the work or which are to be found in any ordinary atlas. We look forward with interest to the publication of the French translation, for in the matter of maps and illustrations the French editions of the first two volumes are superior to the original German work. We owe a deep debt of gratitude to M. Margérie and the other distinguished French geologists who have taken so much pains in the translation of this remarkable work and in the selection of additional maps and illustrations.

Different observers have taken different views as to the structure of Asia, but all are agreed as to the existence of a certain uniformity of plan. Prof. Suess calls attention to the predominance of bow-like forms. Such forms are seen on the shores of the Pacific and in the festoon-like arrangement of the adjacent islands, on the Ganges, the Indus and in Iran. The bows may be strongly or weakly bent, crowded together or separated from each other, but they are always arranged in such a way as to suggest a relation to some central nucleus. This nucleus the author finds in the neighbourhood of Irkutsk and Lake Baikal. It is a region of Archæan gneisses and schists which has been broken up into "horsts" and "sinkings." The great amphitheatre of Irkutsk which is drained by the Angara forms a notch in "the old nucleus" (der alte Scheitel). It has been formed by sinking and is bordered by powerful faults.

As the nucleus is approached, the forms of the mountains change. In the neighbourhood of the sea volcanoes occur; further inwards the snow-clad peaks of the giant mountains form the dominant features; to these succeed the rock-walls of the Gobi, which rise above the lower ground formed of horizontally stratified deposits. From the Altai to the region south of Lake Baikal and onward to the Upper Amur, the features are characteristic of an old mountain land which has been more or less completely worn down by denudation. The mountains here have rounded summits, and rest on broad bases. The river systems are fully developed, and when rapids occur they can be traced to comparatively recent changes, such as the outpouring of basalt. These are the characteristic features of the old nucleus. To the north of this nucleus the elevations are tabular and are often formed of flat-lying Palæozoic strata capped by later basalts. In the tundra region of the extreme north, marine horizontal strata give evidence of the Mesozoic transgression.

So far we have been referring only to the introduction. The second section deals with Siberia, which is divided into two well-marked areas, the west Siberian plain and the east Siberian tableland. The only eminences which rise above the alluvial flats in the western plain, between the Yenesei and the Obi, are relics of a once extensive sheet of soft Tertiary sandstone. The Middle Jurassic transgression, which is traceable from the Arctic regions over the Petchora to Cracow, extends from Russia through the low grounds of Turan to Baluchistan and round the shores of the Indian Ocean, but has not as yet been recognised in western Siberia. The only traces of the widespread Upper Cretaceous transgression occur in western Siberia at Ajat, in the south-west corner. Marine deposits with characteristic European fossils here lie on folded Palæozoic strata.

The Tertiary seas (Upper Eocene and Lower Oligocene) gained access to Siberia through the Straits of Turgai (south of the Urals), and reached as far as Semipalatinsk and Sosswa. About the middle or end of the Oligocene period, all connection with the European seas was cut off and the flora of the amber forests spread over the regions vacated by the sea. This great negative movement led to the isolation of oceanic areas both in Europe and Asia, and to the formation of extensive salt-deposits.

The east Siberian tableland is bounded on the south by the old nucleus, on the north-east by the bow of the Werchogan Mountains, on the north-west by the mountains of the Taimyr Peninsula and on the north by the frozen sea. The Lena belongs to the tableland, and flows in a valley which is often 300 metres deep. Four elements take part in the structure of this plateau region. The first is the Palæozoic floor, which probably underlies the whole. The lowest beds belong to the *Olenellus* zone. They are horizontal except on the borders of the amphitheatre of Irkutsk. This amphitheatre has already been referred to as a sunken portion of the old nucleus which is bordered by powerful faults. Folding and even overfolding are associated with these faults, and the direction of overfolding, as so frequently happens under similar circumstances, is directed towards the centre of the sunken tract.

The second element consists of plant-bearing beds, which often contain workable coal. *Asplenium whithyense* is common, and the deposits were referred by Heer to the Middle Jura. The rocks are sandstone and conglomerate. Plant-bearing beds of the same general type are widely distributed in Central Asia, and it is practically certain that they are not all of the same age; thus Zeiller has recognised affinities with the Gondwana flora and has referred certain deposits occurring in the Altai Mountains to the Permian period. From a consideration of these plant-bearing deposits the author is led to an interesting generalisation. They indicate a Mesozoic continent on the north comparable with Gondwanaland on the south. Between the two lay Neumayr's Centrale Mittelmeer (the author's Tethys), the marine deposits of which are now traceable in a broad zone stretching from Timor and Sumatra through Tonkin, Yunnan, the Himalaya, Pamir and Hindu Kush to Asia Minor and Europe. Modern Asia owes its origin, therefore, in great measure, to the disappearance of Tethys, the rucking up of its sediments into mighty mountain ranges and the consequent union of Angaraland on the north with the Indian fragment of Gondwanaland on the south.

The third element which enters into the structure of the east Siberian tableland consists of Mesozoic marine deposits, indicating encroachments of the sea from the north at various periods. They have not as yet been traced further south than 62° N. lat., but as the plant-bearing beds of the Angara series have been found in higher latitudes it is certain that the northern boundary of Angaraland must have oscillated backwards and forwards during the Mesozoic period. The marine deposits include representatives of the Middle Lias, Oxfordian, the Volga series and the Neocomian.

The fourth element consists of widespread sheets of basaltic lava. One of these sheets extends from latitude 60° 15′ on the Lower Tunguska to the mouth of the Yenesei. It covers about 6° of latitude and 9° of longitude. These basalts do not stand related to definite volcanic cones. They are of the true plateau type and are thus brought into connection with the basalts of Franz Josef Land and of the Brito-Icelandic province.

On the Lower Tunguska they are associated with deposits of the Angara series, and, although true lavas occur, it is not improbable that the sediments were invaded and sometimes broken up by vast intrusions of a sill-like character, which separated and floated off large masses.

The third section of the work deals with the old nucleus (der alte Scheitel). This extends from the Yenesei above Krasnoyarsk eastwards to the Great Chingan range and as far south as the Gobi Altai. East of Lake Baikal the dominant strike is south-west or west-south-west, west of Lake Baikal it is south-east or east-south-east. These two dominant strikes were produced by pre-Cambrian earth-stresses, but they have determined the directions of the later folding and faulting on the borders of the amphitheatre of Irkutsk and in other regions.

In addition to granites, gneisses and schists, the only rocks entering into the composition of the area in question are fresh-water Tertiary formations and basalts—the latter are allied to those occurring in the tableland of east Siberia. The period of eruptions must have been of great duration, for basalt is found, not only capping the ancient hills of gneiss and schist in horizontal sheets, but occurs also in the beds of existing valleys. The district has been broken up into "horsts" and "sinkings," which are described in great detail from the writings of Russian geologists. Many of the "sinkings" are shown to be of the rift-valley type (Gräben).

The fourth section treats of the Great Chingan range, the plain of the Upper Amur, the Aldan mountains, the Lesser Chingan, Manchuria, Sichoto-Alin, Hokkaido, Sachalin and the Japanese islands. Over the whole of this vast area the author recognises a common type of structure. We will give his views as nearly as possible in his own words.

> "In the fruitful plain of the Amur, through the dark primeval forests of the Turkana mountains and the Lesser Chingan as far as the deserts of Sachalin and the great oceanic depths off the Japanese coast, a common arrangement of the leading lines (Leitlinien) finds expression in the convergence of all the curved mountain ranges towards the north of the Sea of Okhotsk. . . . Could we remove the waters of the ocean we should then see the curved rows of islands standing out as mighty mountain ranges. Curve follows curve (Bogen reiht sich an Bogen), and the wonderful agency by which all these curved chains have been produced appears to have proceeded outwards from the central nucleus and to have extended its operations beyond the limits of the modern coast-line."

As the Pacific Ocean is approached, marine deposits of Mesozoic age are met with and traces of the Middle Cretaceous transgression are found in the island of Sachalin. But the plant-bearing beds of the Angara series occur in the plain of the Amur and in Manchuria, thus indicating an extension of Angaraland which has been dropped down in successive steps towards the east by faults and flexures. In spite of this, however, the land area must have increased where the marine Mesozoic strata occur. This increase may have been caused in part by folding, but is probably due, in the main, to a draining off of the sea-waters to fill oceanic depressions formed elsewhere.

Angaraland, which in some parts of Asia goes back to the Carboniferous and in others at least to the Rhætic periods, furnishes an illustration of the permanence of continental areas, though not in the sense in which that expression is usually employed. Since life first appeared on the planet, the phylogenetic thread has never been broken, although evolution has not been continuous and uniform. For the dwellers on the land and in fresh-water the continuity of this thread requires the permanence of continental areas for long periods. Angaraland must, therefore, have been of great importance from a biological point of view. Throughout a large portion of geological time it must have been, not only a retreat for terrestrial and fresh-water forms of life, but also a land capable of sending out colonists as occasions arose.

Enough has now been said to give an idea of the nature of the book and of the method of treatment adopted by the author. The contents of the remaining sections will only be indicated. The fifth and sixth deal with the Altai and the more or less related chains which the author groups under the name of the Altaides; the seventh with the Yarkand-arc and with Iran and Turan; the eighth with the principal ranges of Asia Minor; the ninth and last treats of northern Europe.

Geologists may differ on many points discussed by the author, but no one can complain of the way in which he has presented his views. He is never dogmatic. His method is to marshal the facts and suggest the conclusions to which they point. One of the most delightful characteristics of the book is the sympathetic interest which the author shows, on almost every page, in the labours of other workers. His sympathies are as all-embracing as the views which he has formed as to the origin of terrestrial features.

The French translations of the first two volumes have already been referred to. The extensive knowledge and great literary skill of M. E. de Margérie, under whose direction the translation has been carried out, are a sufficient guarantee of the excellence of the work. It has evidently been a labour of love with the translators, who have treated their author with that respect which should always be shown in such cases. In two respects the translations are better than the original work. The number of maps and illustrations has been greatly increased (128 as against 43 for the second volume), and the notes, which are voluminous and often very important, are given at the foot of the page to which they refer instead of at the end of each section. Moreover, the notes and references have been brought up to date, but all additions are indicated by the use of square brackets.

J. J. H. T.

THE CHEMISTRY OF DYEING.

A Dictionary of Dyes, Mordants and other Compounds used in Dyeing and Calico Printing. By Christopher Rawson, F.I.C., F.C.S., Walter M. Gardner, F.C.S., and W. F. Laycock, Ph.D., F.C.S. Pp. 372. (London: Charles Griffin and Co., Ltd., 1901.) Price 16*s.* net.

THE technology of dyestuffs and dyeing materials has acquired in recent years such a degree of complexity that a dictionary of the subject has become almost a necessity. This want is now supplied by the handy volume before us. Although essentially a dictionary and not to be regarded in the light of a text-book, it nevertheless contains many excellent articles on the chemistry and technology of textile fibres and colouring matters, and should be a most valuable work of reference for all engaged in the arts of dyeing, bleaching, calico printing, paper staining, &c. The book is issued as a companion volume to the well-known "Manual of Dyeing," by Knecht, Rawson and Loewenthal, to which in some respects it serves as a supplement. The methods for the commercial analysis of the various chemicals, mordants and dyeing materials are treated with considerable detail. With regard to colouring-matters a careful system of classification is employed, each group being given a special article, *e.g.*, acid colours, basic colours, direct cotton colours, mordant dyes, &c., and under each of these headings we find a fairly complete list of all the colouring-matters of the particular group at present in use. For further information with regard to individual dyestuffs, each name must be separately consulted. Excellent general articles are also to be found upon indigo, tannin matters, action of light upon dyes, and upon the analysis, valuation and detection of coal-tar colours.

On the other hand, besides a few superfluous articles having little or no bearing on the subject of dyeing (*e.g.*, the headings Acetaldehyde, Acetanilide, Antifebrine, &c.), there are some serious omissions. Thus no method is given for examining the quality of commercial betanaphthol, a matter of much greater importance to the dyer or printer than the isomerism of the sulphonic acids of dioxynaphthalene or of alphanaphthylamine, the reference to which might well be omitted. Again, there is no article upon paranitraniline, but only a cross reference under "Paranitraniline red" to "Azo colours on cotton," where no description is to be found of the properties or methods to be employed in examining for purity this most important product. The same remark applies to dianisidine, only "Dianisidine blue" being referred to under "Azo colours on cotton." The heading of the last-mentioned article should surely have been "Insoluble azo colours on cotton" or "Azo colours produced on the cotton fibre," since all the substantive benzidine colours when applied to cotton might equally be styled "Azo colours on cotton." We also fail to find any reference to sodium sulphide, bronze colours, discharges, persulphates or titanium mordants.

Under the individual colouring-matters there might have been given in some cases a rather fuller account of the special tinctorial properties and degree of fastness to reagents (soap, alkalis, acids, &c.) To provide for these additions considerable space might have been saved by the omission of the names of obsolete colouring-matters and of obsolete names of colouring-matters still used (for instance, aldehyde green, azuline, canelle, heliochrysine, and many others).

A few errors are noticeable in the text, as, for instance, in the article "Janus colours," which latter are stated to be sulphonated basic dyes, whereas in fact they contain no sulphonic group, but are azo-compounds, which owe their solubility and peculiar dyeing properties to the presence of strongly basic ammonium or azonium groups. Again, thioflavine T is given as a derivative of primuline, whereas it is the methylated ammonium compound of dehydrothiotoluidine. The list of manufacturers of colouring-matters given on p. 94 and also opposite to p. 1 is scarcely up-to-date, one of the firms mentioned having ceased to exist, whilst two others have been reconstituted under new names. In spite of the above defects, which can readily be rectified in subsequent editions, the work may be confidently recommended to all engaged in the textile and tinctorial industries as an invaluable lexicon of the subject.

ANIMAL LIFE OF THE CONGO FOREST.

The World of the Great Forest; How Animals, Birds, Reptiles, Insects Talk, Think, Work and Live. By Paul du Chaillu. Pp. xv + 323. Illustrated. (London: Murray, 1901.) Price 7*s.* 6*d.* net.

IN the outlandish and almost unpronouncable native names of animals which form the chapter-headings and recur with wearisome iteration in the text, this volume reminds us of Longfellow's "Hiawatha," although, in our opinion, without affording anything comparable to the pleasure which may be experienced in reading the latter. The author appears to have taken as his model that delightful book of Mr. Seton-Thompson's, "Wild Animals I Have Known"; but if so he has, we think, succeeded in producing only a very poor and feeble